1.9 Recognition of the Need for Studies of the Growing Scientific and Technical Information Field

Just as the thaws of spring release and swell mountain torrents, so the shift from "small science" to "big science" released a veritable flood of new scientific and technical literature and data. The expansion of research and development programs in the Federal government during and after World War II was dramatic. Even without the timely intervention of Senator Humphrey in forcing leaders of the Federal government to improve Federal scientific and technical information systems, sheer necessity would have driven them to undertake such a course of action. Up to World War II, the Federal government was largely dependent on non-government sources for the technical information that fueled its mission-based programs. Much of the knowledge came through the science literature that provided the bulk of scientific and techical information to all users. A considerable part of the knowledge came from industrial sources at home and abroad. But the entire circulatory system was small in comparison to what lay ahead, when the arterioles would become arteries, and when the gravity-driven flow would give way to the power of electronically-driven pumps that could handle the large volume of new scientific and techical knowledge.

Without the existence of a central group with authority, power and resources to plan the shift from the "small information resources" to"large information utilities", there ensued a period of scrambling as each information facility or service in and out of the government took steps to cope with reorganization and restructuring. Even had there been such a group in place, the task would have been herculean since there were no blueprints, no precedents and no experts with the creativity to accomplish the task.

Since ours is a pluralistic society that achieves through hard-won consensus, the task of creating a national information system of articulating, cooperative subsystems was and remains almost unachievable in light of the fierce determination of all information generators, handlers and users to operate with independence and autonomy. The problem becomes even more complex because of the influx of new information tech-

nology, whose diffusion is seldom even in time and space, but whose use is mandatory to success. Moreover, the cost of transferring a society from its conventional information system, based on the printed word and some electronic transmission capability, to a higher order universal information system, based on electronics throughout, is beyond ability to predict. The difficulty of transporting the people into such a sophisticated information society, in terms of education, retraining and mental conditioning,is staggering. The effect on all institutions, governments, and the citizens in undertaking such a passage - assuming that there would be agreement that it should be done - could be shattering during the transition. To accomplish a "break-through" program in any one country would be a miracle, but to contemplate doing this on a global scale boggles the imagination.

Yet, the dynamics of the coupled information explosion and the information technology revolution is propelling elements of societies towards this objective, and their actions are setting up galvanic forces that are midwifing both positive change and attendant dysnomia. To appreciate this thrust, it is revealing to attend a meeting of almost any group of futurists who are tracking the revolution and fueling it with their visions. The spearhead advances of these small cells of activists breaking away from conventional information systems without plan, or with the merest of plans, is a matter of concern to those who are unconvinced that this approach will result in a homogeneous array of national information systems that operate efficiently and economically. On the other hand, those groups that are moving ahead can hardly be faulted for the failure of society in general for not insisting on more concerted action.to plan ahead.

One group that has intermittently sought to determine what steps to take to improve its information processes is the Federal government. One reason for its involvement has to do with the magnitude of its own information processes, undoubtedly among the largest in the world. That it generates unbelievably huge amounts of information in its legislative, judicial, research and development, regulatory, administrative, wel-

fare, personnel and other programs there is no doubt. As the largest patron of science and technology in the country, its production and use of scientific and technical information is fabulous. The magnitude of the dissemination of scientific and technical information directly or indirectly through non-government organizations that are subsidized by the Federal agencies is also legendary. The Federal government was impelled by these realities and the expectation on the part of many non-government groups in the information field to provide some degree of leadership in charting directions, formulating policy. assisting with resources, preparing standards, and exploiting the new information technology. This it did sporadically during the late 1950s, the 1960s and in the 1970s. Some of these efforts will be briefly described. There were other similar efforts in the private sector in the United States and by other foreign governments. A few of these will also be described briefly.

"BAKER REPORT"

Title: Improving the Availability of Scientific and Technical Information in the United States.

Sponsor: The President's Science Advisory Committee, Washington, D.C.

Date: December 1958

Summary: The Baker Subcommittee report was a unique first of its kind. In issuing it, a Presidential news release accompanied it with a call on the National Science Foundation to take the leadership "in bringing about effective coordination of the various scientific information activities within the Federal Government."[1] He asked all Federal agencies whose programs involve scientific information "cooperate with and assist the National Science Foundation in improving the Government's own efforts in this area." The news release also contained as statement by Dr. James R. Killian, Jr., Special Assistant to the President for Science and Technology describing the growing dimensions of world scientific publication and the need for attacking the problem at the national level. The report expressed the hope that scientific societies and other private groups would continue to cooperate with and assist tthe Federal government in the achievement

1 Release to the press by Anne Wheaton, Press Secretary for the President, December 7, 1958, 8 pages.

1.9 continued

of long range solutions to scientific information problems. The report starts off with the question - what the problem is and why it is serious. What it found was that the present literature was increasing so rapidly that it could not longer be published and handled with existing methods. This in turn was placing insuperable problems in front of working scientists to keep informed, especially with the amount of information originating in foreign languages. The present system of primary and secondary publishing was described, also the birth of data centers, which are now known as information analysis centers. The Baker panel saw these as a solution when publication in given fields becomes too great for book publication. The proliferating unpublished technical report turned out by Federal agencies in their R&D programs and the increasing number of technical theses and dissertations were cited by the panel. Striking a familiar note, current in the early post-World War II period, the Baker group stated: "Our very progress in science is dependent upon the free flow of scientific information for the rate of scientific advance is determined in large measure by the speed with which research findings are disseminated among scientists who can use them in further research."

After reviewing what is being done in the field, the panel addressed the problem of a centralized or a decentralized approach and agreed that the latter solution was more desirable. It concluded that the National Science Foundation, which already had responsibilities in science communications should, should expand its program to put it in the science information service business, while playing a coordinating role with respect to basic reasearch and policy matters within the Federal government.

The "uniqueness" attributed to this effort, mentioned above, was that the report was issued with a directive for Federal agency action. The eminence of the Baker Subcommittee as well as the parent group, the President's Science Advisory Committee, the involvement of the President, and the fortunate fact that one of the members of the Subcommitee was Alan T. Waterman, Director of the National Science Foundation, all of these contributed to the success of the early NSF program and the "rousing send-off" of the Federal scientific and technical information program. Another dividend was the lifelong interest in Federal science communications for Dr. William O. Baker, President

1.9 continued

of the Bell Telephone Laboratories, a scientist who recognized long before his peers that science communications, long the exclusive domain of individual scientist and learned societies, was going through a serious transition and that other principals were going to play a role in ultimate developments. Thus, scientists had to pay attention to, and participate with others,in the growing "institutionalization" of the process.

"CRAWFORD REPORT"

Title: Scientific and Technological Communication in the Government

Sponsor: Office of Science and Technology, Executive Office of the President

Date: April 1962

Summary: The terms of reference for this six-man task force, which was chaired by Dr. James H. Crawford, Jr., Associate Director of the Oak Ridge National Laboratory, were developed from a letter from Dr. J.B. Wiesner, Special Assistant to the President for Science and Technology, establishing the group: He wrote:[1]

> "The proper organization and coordination of the various scientific and technical information activities of the Federal Government so that they best serve the needs of different management levels is of critical importance to the efficient and effective prosecution of the Government's expanding research and development programs. I hope, through this task force, to develop a more comprehensive understanding of the scientific and technical information needs for the conduct of these programs, to assess the strengths and weaknesses of existing and planned scientific and technical information activities, and to determine whether there is need for improved procedures and organization for the handling of scientific and technical information."

During the course of the study, the task force conferred with more than 40 persons involved in scientific and technical information policy and operations in all parts of the Federal government. It also conferred with Dr. Alvin Weinberg, chairman of the President's Science Advisory Commitee's panel on Science, Government and Information, which was also engaged in a White House-generated study concurrently.

[1] Office of Science and Technology, Scientific and Technological Communication in the Government, Task Force Report, Washington, D.C., April 1962, pp 81.

1.9 continued

In analyzing the problem, the task force cited the growth of research and development in the government, as did the Baker panel; this was producing both information and communication problems in turn. Three information areas were investigated: scientific and technical information needed for research and development and generated by the Federal programs; resources information and data needed for management of research and development; and information about science and technology. The problem was national, not only Federal, in scope. The panel discussed the difficulty of access to the growing mountain of scientific and technical information for all researchers, also the problem of information quality. It found that research scientists were somewhat better off than engineers in need of screened facts or data. Both communities were in need of a interdisciplinary information system. R&D managers in the Federal government were only partially knowledgeable about the problems in their agencies, especially at the lower levels. It saw the need for better interchange within theFederal government, as well as the need for smooth flow to non-government science and technology groups. This would result in a beneficial positive feedback to Federal programs.

The Report made several recommendations:

1. In collaboration with its agency counterparts, the recommended focal point for Government-wide direction and review should develop and announce a logical structure of defined functions which will guide all activities involved in the management and operation of the Federal Government's STINFO system.
2. Government- and agency-wide focal points of responsibility, in close cooperation, should also develop and guide the application of realistic criteria to govern the functional operations of the communication process.
3. There should be established within the structure of the Executive Branch a Government-wide clearinghouse capability for information regarding currently planned and active research and development efforts, for documents reporting the results of Federal R&D, for retrospective search and retrieval services of Federally-supported, organized collections of STI, for coordinated access to Federally supported specialized information centers and services, and for formal scientific and technical meetings supported by the Federal government.(Note: the panel

1.9 continued

called for clearinghouse functions, but did not state that they all be undertaken in one or more facilities, although this might be inferred in the implementation plan, starting on page 58.)

In retrospect, the Crawford Report was an influential contribution. Not all of its recommendations, primary and secondary, were implemented, but several were. Interestingly, the analysis of the problem made by the panel would not differ substantially from the problem today, two decades later. But unlike the climate for progress that was apparent in the early 1960s, the Federal agency R&D managers today have an environment much less conducive to the accomplishment of the goals set forth by Jerry Wiesner in his charge to the Crawford task force.

WEINBERG REPORT [1]

Of all of the studies of Federal scientific and technical information matters, the Weinberg Report has probably received the most attention in the United States and the world. Although the Baker and the Crawford reports were equally meritorious, the Baker Report had a more universal appeal, it seemed, to a larger science and information universe. It also provoked some alarm in the library field, thus stimulating more discussion than its predecessors, being the third of a series and accenting the determination of a string of concerned Administrations to strengthen this area. In a sense, it was a watershed effort informing the international community of scientists and engineers that science communications in the United States was in line for new and higher priority. The eminence of the panel was such to guarantee attention to its product. Both Baker and Crawford were members. Others were Karl Cohen, General Electric Co.; manager of advanced engineering; Louis P. Hammett, Mitchill Profess-

1 Weinberg, Alvin M., et al, Science, Government, and Information: The Responsibilities of the Technical Community and the Government in the Tranfer of Information, Report of the President's Science Advisory Committee, The White House, Washington D.C., January 10, 1963, pp 52

or Emeritus of Chemistry, Columbia University; A. Kalitinsky, Program Director, NOVA, General Dynamics/Astronautics; Gilbert King, Director of Research, IBM Research Center; William T. Knox, Manager (Planning), Esso Research & Engineering Co.; Joshua Lederberg, Stanford University Medical Center; Milton O. Lee, Executive Secretary, Federal of American Societies for Experimental Biology; John W. Tukey, Professor of Mathemetaics, Princeton University, and Associate Executive Director, Bell Telephone Laboratories; and Eugene P. Wigner, Thomas D. Jones Professor of Mathematical Physics, Princeton University. The contributions of Francois Kertesz, Oak Ridge National Laboraty, who acted as the recorder and executive secretary of the panel, were also outstanding.

President John F. Kennedy, ten months before his death, blessed this report with his statement: "It makes a welcome contribution to better understanding of the problems of scientific and technical communication both within the Government and outside of Government...(since) strong science and technology is a national necessity and adequate communication is a prerequisite for strong science and technology."

There are about 200 recommendations in the report, obviously too many to cover in detail, calling on government agencies and technical community (scientists and engineers) to undertake actions to improve research and development. A special section at the beginning of the report provides a summary and the major recommendations made by the panel and accepted by the President's Science Advisory Committee.

One of the key contributions of the report is the section on the nature of the information problem, a problem which persists today. Some of the findings in this section are summarized as follows:

> "...because of the tremendous growth of the literature, there is danger of science fragmenting into a mass of repetitious findings, or worse, into conflicting specialties that are not recognized as being mutually inconsistent. This is the essence of the "crisis" in scientific and technical information.

"Inasmuch as the Federal Government now supports three-fourths of all science and technology in the United States, it has a responsibility to prevent our scientific-technical structure from becoming a pile of redundancies or contradictions simply because communication between the specialized communities or between members of a single community has become too laborious. Moreover, since good communication is a necessary tool of good management, the Federal Government, as the largest manager of research and development, has a strong stake in maintaining effective communication. The problem is not the Federal Government's alone. Science and technology are the business of many who are outside government. Each...community has developed methods to cope with the difficulties in communication...(since) these systems have grown up in isolation, they too often tend to further fragment our already disjointed scientific structure. The Federal Government alone interacts with all of the elements of our information systems; it is uniquely able to examine the overall problem from a properly general viewpoint and to guide and otherwise support measures for unifying our communication and so preserving that unity of science and technology that is indispensable to their effective pursuit.

"Modern science and technology cost our society dearly, and our society is justified in demanding its money's worth...The existence of a healthy, unified, impartial, and sophisticated system of scientific communication - indeed, of scientific criticism - helps to assure society that the science it supports is a responsible and worthwhile undertaking and not merely an avenue of self-expression for an elite group."

At the time the Weinberg Panel made these observations, the United States was enjoying world leadership in science and technology. The defense and space programs were so highly respected around the world that leaders in other countries were grumbling about "brain drainage" to the United States from their countries and a "technology gap" which they attributed to the influx of Federal funds into government research and development, especially defense and space programs. Public statements such as the Weinberg Panel made in its Science, Government and Information Report about the need to improve Federal and national scientific and technical information probably had as much as any other causation to convince other countries to accelerate their own information programs and worry about United States leadership in science, technology and scientific and technical information.

Here are some of the recommendations that were made to scientists, engineers, professional societies, universities and professional societies:

> "1. This community must recognize that the handling of technical information is a worthy and integral part of science.
>
> 2. The individual author must accept more responsibility for subsequent retrieval of what is published.
>
> 3. Techniques of handling information must be widely taught.
>
> 4. The technical community must explore and exploit new switching methods...(such as) specialized information centers, central depositories, mechanized information processing, software for analyzing, indexing, and programing, and more uniform practives for rapid and efficient switching between systems.

Recommendations to the Federal agencies included:

> 1. Each Federal R&D agency must accept its responsibility for information activities in fields that are relevant to its mission (including devotion of) an appreciable fraction of its talent and other resources to support of information activities.
>
> 2. Each agency...should establish a highly placed focal point of responsibility for information activities that is part of the R&D arm, <u>not of some administrative arm</u>, of the agency. (Underlining added)
>
> 3. The entire network of Government information systems should be kept under surveillance by the Federal Council for Science and Technology. (FCST's formation of the inter-agency Committee on Science Information is applauded.)
>
> 4. The various Government and non-Government systems must be articulated by means of the following information clearinghouses: current efforts, technological efforts, report announcement and distribution, retrospective search and referral service, specialized information center directory and formal technical meeting register.
>
> 5. Each agency must maintain its internal system in effective working order. This includes technical report refereeing, adequate technical reporting by contractors, improved handling of security and declassification, support of critical review journals, concentration by the large central agency depository on document wholesaling, and sponsoring and support of additional specialized information centers.
>
> 6. Problems of scientific information should be given continued attention by the President's Science Advisory Committee, (such as) balance between Government and private information activities.

It should be clear to the reader that the private sector referred to in the Weinberg Report did not include the then tiny commercial information sector which has grown in the intervening years. The Panel did not anticipate the growth of electronic data bases and networks to the considerable number and size that they have attained.It did not anticipate the intervention of national governments in all phases of information and communication programs and products. Nor did it consider that future Presidents and their science advisers would diminish their support for better science information processes in the Federal government. Notwithstanding failure to foresee the future, Alvin Weinberg and his remarkable Panel made history with their remarkable Science, Government," and Information. It needs to be updated and re-issued to every scientist and engineer in the public and the private sectors.

A.D. LITTLE REPORT [1]

While not usually categorized as a major report on scientific and technical information, Centralization and Documentation is included as one of the early reports prepared in the early 1960s to provide the National Science Foundation with guidance it needed to make a decision. The contractor was asked to consider the feasibility of centralizing facilities for the storage and retrieval of scientific documents. One of the purposes of such an inquiry was to determine if the establishment of such a facility would help detect potential duplication of research and technical effort, very much a concern in that time-frame. Another purpose was to determine if the state-of-the-art in information technology and techniques would enable the improvement of storage and retrieval of the literature.

[1] Giuliano, V.E. et al, Centralization and Documentation, Final Report to the National Science Foundation, Arthur D. Little, Inc., Cambridge, Mass., C-64469, July 1963, pp 70.

After studying three classes of techniques which might improve the document retrieval process - word thesauri, citation indexes, and statistical methods of index term association -it was concluded:

1. The inadequacies of the larger mechanized searching systems currently available appear to be confirmed by the degree and type of usage which these systens have received.

2. Although a large multi-discipline collections could be searched effectively if it were divided into an assemblage of separate, possibly overlapping, collections, such an assemblage would offer little advantage over present, decentralized, individual collections.

The recommendations to the Foundation were:

1. Not to support large-scale centralization of document searching facilities at this time.

2. Support a comprehensive program to yield additional information and insight about real informational needs of scientists and engineers.

3. Investigate the use of statistical techniques for the automatic generation of thesaurus lists and for the automation of some of the functions now performed by humans. Also test operate one of the medium-sized, operating, coordinate retrieval systems on a statistical associate basis.

TECHNICAL INFORMATION AND THE FEDERAL LABORATORY - A SYMPOSIUM REPORT [1]

An account of the second FCST symposium on "Technical Information and the Federal Laboratory" is included because of the character and magnitude of the program, as well as the level of the sponsoring organization, the Federal Council for Science and Technology. In the Foreword of the Report, Donald F. Hornig, the Science Advisor to the President said:

"In an organization as large as the U.S. Government, it is exceedingly difficult for broad policies to be translated into effective action at the local laboratory level within a reasonable period of time... This conference was convened to consider the ways in which technical information activities interact with the Federal laboratory. There should be no doubts about the importance that my Office attaches to efforts to improve technical communication within the Government and between Government agencies and the public. I recommend that every R&D administrator, every technical manager,

[1] Hooper, William L., Proceedings of the Second Symposium on Technical Information and the Federal Laboratory, Federal Council for Science and Technology, Washington, D.C., April 13-14, 1964, pp 88.

> and every scientist and technical person in the Government analyze his own technical information role and, with the help of this volume, make an effort to improve his capabilities in this regard...Some progress can be made in the scientific and technical field by developing sound Government-wide policies and programs. But primary responsibility lies with the individual laboratory director and his senior scientist. Here is where innovation and experiment can return the greatest dividends..."

More than 100 Federal officials and their guests participated in the two-day symposium.The moderator was Allen V. Astin,Director of the National Bureau of Standards. Emerging from the symposium were several agreements or generally accepted observations. Some of these are:

> "Critical problems exist in establishing (and maintaining) effective communication between scientific disciplines and, more importantly, between scientists and those who are charged with applying new scientific knowledge for the benefit of society.
>
> "The climate for innovation in the improvement of technical communication is the responsibility of research management, which decides intuitively that the added cost of a new information system will be more than recaptured through organizational efficiency...Few, if any, new approaches will be undertaken if the laboratory management itself is not sympathetic to change.
>
> "The individual scientist who is considered highly productive by his superiors and his fellow workers has been found to place a higher value on using his knwoledge or on learning new knowledge and skills than on most other job attributes, thus avoiding technical obsolescence.
>
> "The individual who takes the intiative to solve his own technical information problems will have a powerful effect on his own associates and his organization.
>
> Assimilation and use of information is not a "one shot" process. Four stages occur in the creative efforts of individuals: (1) mental labor of preparation, (2) incubation or gestation, (3) illumination (a-ha!) and (4) elaboration and verification. Access to information systems are needed which promote and amplify the interacting efforts of these four stages.
>
> "The generation or production of technical information demands greater self-control and greater skill on the part of the individual scientist, engineer, or practitioner. There is an urgent need for a new set of ethics about publication, and there is an equally urgent need for clear expression.
>
> "The productivity of the organization is directly related to the kind of technical communication that takes place. (Underlinging added)
>
> "There is a general lack of policy at the local laboratory level on such matters as responsibility for technical communication, quality of information services, coordination with related systems or services, and status of technically trained personnel engaged in technical information activities.

There are many more observations and explanations made by the participants. Speeches made by Alvin M Weinberg, James A Shannon, Derek De Solla Price, Edward Wenk, Jr., Lt. General William J. Ely, and others are reported along with the dialogue among the speakers and the audience. A number of case studies were introduced by special speakers and a policies and practices forum was moderated by F. Joachim Weyl who, several years later, was the Executive Secretary for the National Academy of Sciences-National Academy of Engineering Committee on Scientific and Technical Communication (SATCOM) effort. The purpose of the Symposium, as stated by Hornig, was to stress the importance of scientific and technical information in the Federal government. The participation of all of the laboratory leaders in the program ensured the passage of this policy down to the operating level. It demonstrated the resolve of the Science Advisor and the Federal Council for Science and Technology - the leaders of science and technology in the Federal government - to improve the STI process as a priority and a long time requirement. Nothing quite like this effort has ever been repeated.

WARREN PROPOSAL[1]

The spread of the scientific and technical information virus unexpectedly produced a proposal for a National Library of Science System from the President's Special Assistant for Mental Retardation. Warren's effort was atypical because it was a one-man production, although it was approved by the Advisory Committee to the Special Assistant to the President for Mental Retardation. Warren's plan resulted from recognition of the problem of scientific communication discussed by the Advisory Committee and other organizations in the Federal and the private sectors. It was also influenced by other actions and discussions by the President's Science Advisory Committee which were known to Warren residing as he did in the Old Executive Office Building.

Warren recognized that it was no longer possible for the scientist to find by conventional library methods all of the published scientific studies and reports he needs in his field of research because of the increase in volume of publication. In his memoran-

[1]Warren, Stafford L., National Library of Science System, A Proposal to the President to Develop a Comprehensive combuter-based National Library of Science System and network from Stafford L. Warren, M.D., Special Assistant to the President for Mental Retardation. February 17, 1964. p.p. 36. (unpublished)

dum to the President, Warren wrote:

> "Modern processing techniques must be used to pool all published scientific articles and make them all available to all users wherever they may be...It is urgent that a national system with single standards and codes be set up as early as possible, so that...scattered efforts be coordinated into a comprehensive system thus eliminating duplication, increasing research efficiency, and reducing costs. Such a unified system would facilitate communication with foreign scientists and could become an important bond between nations. Legislation and funds are necessary to design, build and operate the system and its network. There is also a need for a crash educational program for new types of librarians. We must devise hardware and apply the appropriate standards and codes. Prompt action is urged in order to preven further complication and chaos in the field. The project will have enthusiastic support from the scientific community. Its accomplishment will be a scientific breakthrough of tremendous importance."

The essence of the Warren approach is the need to build on the foundation of the library, which he points out in his Preface, "...has been the heart of educational and research institutions from time immemorial, serving the advanced student, scholar and investigator." The rapidly growing disciplines in the sciences, especially in biomedicine,behavioral and physical sciences, the great increase in research findings which are overwhelming the library system and current procedures, these are creating a chaotic situation, thus the need for a single National Library of Science System. This system, will use "the most sophisticated technological tools available to permit both effective control and use of this otherwise overwhelming volume of literature, and which would give every library access to all of the published scientific literature for its users."

Referring to the paralysis of the library system, Warren painted a picture that showed that:

1. Research and university libraries are acquiring only a small part of published literature, thus forcing them to restrict their holdings to the core of their clientele. Lack of space to house added collections and the lack of funds to buy them apparent.
2. Introduc tion of modern computer technology has been desultory.
3. Abstracting and indexing services..have not helped exploit the published literature for use in libraries.
4. R&D efforts to solve the problem have brought fragmentary results.
5. Individual scientists have not been well served by the libraries.

It was Warren's finding that only "the National Library of Medicine had attacked the problem aggressively with regard to the published periodical literature in designing a computer-based system to permit more effective exploitation of the biomedical publications."He added, " However, even this agency has not yet been able to provide service in the depth and breadth that would show signs of alleviating the larger problems."

Warren also expressed the view that:

> "The problem is also well known to organizations in the private sector, as evidenced by almost every major professional association engaged in the first steps which are aimed at standardizing nomenclature in an effort to work toward computer based systems. However, these activities have been largely uncoordinated and appear to be chatoic when viewed nationally. In addition, there has been a proliferation of specialized information centers throughout the Nation, variously estimated as 450 to 3000 in number, which up to now have had no way of coorcination into an effective national resource. Accordingly, a new administrative concept of a National Library of Science System and network is proposed which would build on existing efforts, particularly on the effective start made by the National Library of Medicine."

On page 4 of the Background, there is a handwritten statement, presumably written by Warren, which stated: "The new system would not replace any existing libraries but would greatly improve their capacity to serve their customers and users. It would reduce the need for stack storage space in every science library."

The elements of the Warren proposal are as follows: a National Library of Science system would be established to provide a pool of all published scientific literature that would be made available to all claimants at their local libraries. Common standards and procedures would be worked out to include open published literature, report literature, and classified literature. Only the open literature would be available at the outset. Holdings of all libraries would be prepared in the form of a list. Each participating agency would by agreement be assigned a portion of the total which would be part of the pool. Tapes or through other microform, these would be introduced into the pool. The public and private sectors would agree to standards and/or compatible procedures for the acquisition, analysis and coding of scientific articles. A network of regional centers would store the tapes or microform and act as distribution centers. The Library of Congress would form a new division to operate the system and would concentrate its own

effort in the computerization of its law information holdings. The Department of Commerce develop a clearingouse of Federal STI as contemplated under P.L. 776 (81st Congress, 1950), but this should be done in coordination with what core centers are or will be doing. The MEDLARS program of the National Library of Medicine should be adopted as the physical and administrative starting point for the National Library of Science System. An Advisory Committee on Operations should be formed. NLM would be the in-house research unit of the System. Warren proposed a budget for his System that would start with $10 million for 1964-1965 and rise to about $52 million in 1968-1969.

The Warren Proposal was reviewed by the FCST Committee on Scientific and Technical Information in early 1963. Hornig forwarded a memorandum to Warren[1] which made the following points:

> "We do not believe that technical knowledge is sufficiently advanced so that a firm recommendation of a particular system is justified at this time. Two separate panels of the President's Science Advisory Committee have considered centralized bibliographic control of the periodical literature and have rejected the notion as premature. The MEDlars approach of the National Library of Medicine is being watched with great interest as a promising prototype, but we believe that premature commitment to a systems development now can do great damage and in the end cause delay. Much more detail needs to be worked out before the library approach you espouse could be judged. This has not yet been done."

A second memorandum[2] from Hornig to Warren stated:

> A COSATI meeting was held on March 10, 1964. Here is the thinking expressed at that meeting: The Warren approach is bold, but it raises a significant number of questions before any action should be con templated. The technical capabilities of the system are in doubt; the costs would be large as a recent Library of Congress automation study indicated. Careful consideration needs to be given to such non-government programs as Chemical Abstract's. You are correct in stating that standards and procedures are not yet ready to be employed. A special task force of COSATI is being formed to consider yours and other proposals that are being made. The roles of the publishing industry, commercial services for secondary publication, the professional societies, the Library of Congress, the National Library of Medicine, National Agricultural Library, and the Executive agencies of the government will be considered by this task force. The task force will consult with you during their efforts."

[1] Memorandum from Hornig (OST) to Warren, February 14, 1964.
[2] Memorandum Hornig to Warren, March 30, 1964.

The significance of the Warren Proposal was that it advanced an alternative approach based on the expansion of Federal and other libraries into a system that would be national in its scope and operation. The defect of the proposal was that it paid too little attention to other groups in and out of the government, which were also proceeding in the same direction; but it was conceded as a one-man effort, the Warren product had to be commended. Perhaps its ultimate contribution was that it stimulated COSATI to form a task force to consider the Warren vehicle among other proposals for a national information system.

LICKLIDER REPORT[1]

As stated in the introduction of the report, the panel's deliberations were "anchored in the thinking of the Baker Panel, the Crawford Task Force, and the Weinberg Panel." The same broad problems were addressed, but the Licklider group concerned itself more with libraries than the three task forces did. Licklider writes:

> "The context of our study included (1) the Government's arrangements developing under the aegis of the Federal Council for Science and Technology (FCST) and the Committee on Scientific and Technical Information (COSATI) to facilitate the flow of scientific and technical information, the vast but amorphous "usership" of information in government, industry, the universities, and the public, and (3) the rapidly advancing technology of information. Our purpose was to examine and assess for you the situation in, and the trend of, scientific and technical communication --particularly from the point of view of the non-government scientist, but from other points of view--and to give you simultaneously a progress report and an evaluation."

The Licklider Panel saw a basic dilemma facing the government. It had two types of responsibiliy. The first was the need to take the initiative, develop policies and impose its authority within its own domain. Second, when it seeks the cooperation of the private sector of science in the development of an integrated system, it can only exhort, coax, and persuade. Engineers and scientists differ in attitude about improving the apparatus of science communication. The former, along with management, seeks to improve the system,. while the latter is defensive and passive about changing the way he commu-

[1] Licklider, J.C.R. et al, Panel on Scientific and Technical Communications Report, Office of Science and Technology, Washington, D.C. 8 February 1965, pp 43

nicates. In the main, these were the broad trends the panel found in science communications:

> "Information is a field of study in its own right, but it is also part of every other field of science and technology, hence it will take much effort by OST to meld public and private developments.
>
> "Fair progress is being made to implement mechanisms to facilitate use of government-generated STI by the government and the contractor communities.
>
> "COSATI is working hard and doing almost all it can as a committee representing diverse agencies of the government, but it has achieved only partial success in persuading the scientific community to cooperate in integrating public and private services.
>
> " Even though the scientific community is not convinced and the proposals of national systems seem unrealistic, demand for a unified system are progressing from some quarters.
>
> "The field is not yet well enough defined to justify an attempt to design a national system at this time.We need to develop principles dealing with centralization and distribution of functions, also the "real" needs of generators and users of STI.
>
> "A coherent plan and strong leadership are needed.

The recommendations made by the Panel are summarized as follows:

1. OST leadership needs to be strengthened by adding to its staff and increasing its use of panels and consultants.

2. There should be a continuing panel on scientific and technical communication, also a short-term panel on information problems of engineers.

3. In the planning and implementation of the STI system, proper weight should be given to the kinds of communication mediated by books, journals and monographs. Most of government's new efforts are focussed mainly towards "source reports" resulting from government R&D rather than the former. A disproportionate amount of money and effort is going to handling "source reports." Library problems at all levels need more attention.

4. Insofar as scientists and engineers are concerned, what the Federal government is doing to advance STI programs and mechanisms is relatively unknown. More conspicuity is needed to help users achieve access and to understand what the "system" is and does.

5. As encouraged by the framers of the previous reports to the Executive Office of the President, there needs to be more active participation by scientists and engineers who generate and use STI. It cannot be done exclusively by specialists in documentation and bibliographic control. The scient ists and engineers must be part of the development process if the effort is to succeed.

6. Technical writing needs great improvement.

7. While this is not the time to design a national system, it is the time to build experimental or exploratory systems capable of handling actual problems and growing or evolving into operational systems.

During a period of discussion of problems and issues, the Licklider panel came up with a number of findings that were agreed upon short of recommendations. These are summarized as follows:

1. While the notion of information analysis centers that received much attention in the Weinberg Report is a good one, too many of the 200 to 400 centers in being lack the quality that they should have. There is a need for assessment by the National Academy of Science.

2. The centralization of scientific and technical communications is a controversial theme. Thinking needs to be sharpened. Centralization seems appropriate for standardization, monitoring of compatibility, and over-all planning, guidance and evaluation, also coordination of contributions from distributed sources. Actual work of abstracting, synthesizing, organizing and summarizing the literature should be distributed among professional societies, technical information analysis centers, and other groups close to actual R&D.

3. We commend the work of the National Science Foundation, the Department of Defense and the National Insitutes of Health in undertaking user studies, but the existing practice may be a poor source of information about the "real" needs of users.

4.Attitudes towards the use of information-processing machinery seem to be polarized, a development the Panel does not like. Some of the leaders strongly believe that computers will solve the information explosion;others reject computer applications in the context of solving the problems of documents and libraries. Both of these extremes are wrong. The work of Index Medicus and MEDLARS proves their utility, but their success does not prove that libraries can be fully automated. OST, FCST and COSATI should hold to a middle course.

5. Regarding national libraries, in the life sciences the National Library of Medicine is developing in such a way as to serve as the central focus of a system of field-oriented libraries and activities. In natural, social sciences and in engineering, the Library of Congress acts more like a tradtional library with only slow progress in new ways to facilitate scientific and technical communications. There is no lcear picture of what is happening in the US Department of Agriculture Library. If the Library of Congress does not fulfill the role in the natural and social sciences and for engineering, a role should be given to a National Library for Science and Technology operating in the Executive Branch.

7. There needs to be more attention to informal communications in over-all planning.

8. Review articles and monographs need to receive more support from scientists and engineers as encouraged in the Weinberg study.

9. There is a conflict of principles in the area of government subsidy. (a) The government should subsidize publication of STI that it has generated to make sure that it flows. (b) The government should not subsidize selectively one branch of an industry to give it an advantage over a competing branch. (c) The government should not influence the editorial policy of the free press. The problem needs further study.

The Licklider Report did not get wide publicity when it was issued. One reason was the lack of any spectacular conclusions and recommendations. Expectation that this might happen was unreasonable. The essence of the task was that of review of previous reports in light of the passage of time. Only four days of work was a certain obstacle to new and original insights, but that was all of the time provided. While some thought when into consideration of the role of libraries in the systems of the future, most of the attention went to the place of the three national libraries in the grand scheme. Even so, there was less than adequate coverage of what was going on in the three libraries in the report. The thoughts about the need to upgrade the quality of Federally supported information analysis centers and to augment the size of the OST staff were well taken. It is probable that the increase in the number of OST staff people in the science communications area resulted from the Licklider Report recommendations. Bill Baker and Alvin Weinberg served as members of the Licklider panel, as did members of their task groups and the Crawford task group. Their involvement may have brought positive and possibly some negative effects. But, one thing for sure, some of the recommendations of the Licklider Report, like those of the other three studies, still need to be implemented. As a post-script, COSATI distributed the Licklider Report to its Federal agency members for their reaction. On the whole, it was well received, but there were sharp differences on a number of its recommendations and conclusions. The reader should be aware that a summary of their comments is in existence.[1]

1 Aines, Andrew A., Summary of Federal Agency Comments Pertaining to the Licklider Report, Committee on Scientific and Technical Information, Federal Council for Science and Technology, Washington, D.C., 16 August 1965. pp 9.

NATIONAL DOCUMENT-HANDLING SYSTEMS FOR SCIENCE AND TECHNOLOGY [1]

The book produced by the Systems Development Corporation is the commercial version of a report prepared by an ad hoc group of the Committee on Scientific and Technical Information, Federal Council for Science and Technology. The work of the COSATI Task Group on National System(s) for Scientific and Technical Information will be described later in the book under COSATI and its contributions. The SDC publication does contain additional material about the Soviet scientific and technical information gathering, abstracting and dissemination organization VINITI - its purpose and its organization - as the facts were known in 1965. Also reviewed are a number of studies dealing with scientific and technical information development, several of which had not received much attention during the late 1950s and early 1960s. They will be of interest to scholars seeking more details about the burst of plans and proposals that were prepared during that period.

THE WHITE HOUSE CONFERENCE ON INTERNATIONAL COOPERATION [2]

One of the least remembered facts today is that 1965 was International Cooperation Year. and that there was a White House Conference on International Cooperation. An eminent group of citizens was brought together in a committee, the Committee on Communications of the National Citizens' Commission on International Cooperation. The Chairman was Harold Geneen, Chairman of the Board and President of International Telephone and Telegraph Corporation. The other members of the committee were Palmer Hoyt, Editor of the Denver Post, Frederick R. Kappel, Chairman of the Board of the American Telephone and Telegraph Company, William B. Quarton, President, American Broadcasting Stations, Inc., and General David Sarnoff, Chairman of the Board, Radio Corporation of America. Five government consultants also served; they were: Lee Loevinger, Commissioner of FCC, Paul F. Geren, Department of State, General Harold W. Grant, Department of Defense,

[1] Carter, Launor F. et al, National Document-Handling Systems for Science and Technology, Systems Development Corporation, Santa Monica, California, published by John Wiley & Sor Inc., November 1965. pp 344.

[2] Geneen, Harold et al, The White House Conference on International Cooperation, Report prepared for the White Houseby the Committee on Communications of the National Citizens Commission on International Cooperation, November 28-December 1, 1965, pp 25.

Harry D. Yankey, Department of State, and Edgar T. Martin, United States Information Agency.

Because matters dealing with information, computing and communications have have merged during the intervening years, this report is included even though scientific and technical information was not the primary focus of the committee. Additionally, some of the views and findings of the group are interesting. For example, the Citizens Committee was of the opinion that existing communications systems and technology appear "to be adequate for almost any demands which the peoples of the world make upon them." In consideration of the information technology breakthroughs that have taken place in recent years, this would be a naive statement on the face of it. Having come to such a conclusion the Committee found:

> "...that the present need and opportunity is for a marshalling of information technology and communications resources at a central point where those who need and seek information, particularly medical, technical, and educational information, may communicate with those who have or can secure that information."

With the generosity that was present during the 1960s, the Committee went on to recommend that there be established:

> "an institution or agency to perform this function and systematically to communicate information to those who need it in such fields as medicine, agriculture, meteorology, etc.,(and) the implementation of such an agency could have tremendous impact on the peaceful development of peoples and nations throughout the world."
>
> "Accordingly, the Citizens Committee on Communications recommends that the United States propose and support the establishment of the United Nations of an agency to act as a world source of knowledge and reference for the collection, communication, and dissemination of all types of information useful for peaceful purposes throughout the world. The Committee recommends that this agency should be called the Voice of Peace.

"Attention, the universe!" were the first words that Samuel Morse sent as the world's first telegraphic message in 1837. Almost 150 years have passed since that historic date. Since then the world has been "wired up" to the extent that virtually all men and women are able to communicate with each other. The Committee Report describes the many milestones that punctuate the stages of communications between nations and thus is a valuable history book. One paragraph is particularly interesting in light of the effort of the current Administration to sell weather and Landsat satellites.

"In 1865 at a Conference called in Paris, twenty states executed the first International Telegraph Convention and established the International Telegraph Union. Membership in the Union was restricted to government-owned telegraph systems. At the Rome Conference of the Union in 1871 private companies for the first time were represented and participated in discussion without a vote. In 1875 the United States first sent observers to the St. Petersburg Conference of the Telegraph Union. The United States at first had refused "on the ground that telegraph in this country is a private enterprise and not subject to the control of government." The invitation was then extended through the United States to private American companies, and those companies declined. Upon the insistence of Russia the United States finally sent an observer who neither participated nor signed the resulting document..."

Looking into the future, the Committee on Communications, said:

"The ability to transmit by facsimile and braodcast by televison throughout the world, together with the development of facilities for simultaneous translation, will mean that the storehouse of knowledge of every country becomes available to every other country and to the most remote regions of every country. Thus it may be envisioned that the development of communications facilities through both international cooperation and technological advance will greatly facilitate and increase the widespread dissemination of knowledge and the education of masses of every country in the world.

"Whatever telecommunications systems exist or are developed must be used to meet the critical need throughout the world for information, particularly medical, technical and educational information, which is indispensable to social progress in all areas, especially to communicate information to those who need it in fields as medicine, agriculture and meteorology could have tremendous impact on the peaceful and healthful development of peoples and nations throughout the world. Accordingly, it is recommended that the United States propose and support the establishment by the United Nations of an agency to act as a world source of knowledge and and reference for the collection,communication and dissemination of of all types of information useful for peaceful purposes through the world...(The) agency should be called the VOICE OF PEACE (and) staffed on a continuous basis by the developed nations of the world. It would constitute a central point of information, query, storage and reference for use by all participating nations. The computer-based center would gather, store, process, program, retrieve and distribute information and advice on the broadest possible scale..."

How would the VOICE OF PEACE be supported? The Report concludes with the recommendation:

"That the United States propose establishment of and offer full support to a new agency of the United Nations to be called the VOICE OF PEACE."

There are two amazing aspects of this report: (1) it got virtually no attention in the press, even though it was prepared by a group of "hard-nosed" business men, and

(2) it turned out that the recommendation really called for a world-wide scientific and technical information center, a concept that flew in the face of the way the national scientific and technical information system is developing in the United States. Ironically, the United Nations is becoming more deeply involved in the international flow of scientific and technical information, but this will be covered in another chapter of this book.

PIERCE REPORT [1]

The long-awaited Pierce Report was issued early in 1967, another project of the President's Science Advisory Committee, and the Science Advisor to the President, Donald Hornig, whose interest in science communications, computing and communications was unmatched. The focus of the Pierce Panel was primarily on education and computers, but it was generally recognized that scientific and technical communications would be affected by the findings and recommendations of this Panel. This group was also made up of highly competent people. In addition to Pierce, a highly thought of scientist from Bell Laboratories, there were: Thomas H. Crowley of Bell Telephone Labs, Peter Elias of MIT, George Hazzard of Washington University, John Kemeny of Dartmouth College, Thomas E. Kurtz of Dartmouth College, Edward Levi of University of Chicago, Gordon J.F. McDonald of the Institute for Defense Analysis, George E. Pake of Washington University, Joseph B. Platt of Harvey Mudd College, Tobert L. Smith, Jr. of Texas A&M University, Clay Sprowls, UCLA, and David Z. Robinson, Office of Science and Technology.

The first paragraph of the introduction is memorable, observing:

> "After growing wildly for years, the field of computing now appears to be approaching its infancy. Recent revolutionary technological advances will eventually take us far beyond our newest, biggest, and best computers. Yet computers and computing have already fantastically increased out power to know as well as to do. They have made masses of data which were previously completely intractable accessible to analysis and understanding. They have made it possible to trace the consequences of theories and assumptions in a wide variety of fields. As computers and computing have become more powerful, they have invaded wide areas of industry, government, and the pro-

1 Pierce, John R. et al, Computers in Higher Education, Report of the President's Science Advisory Committee, Washington, D.C., February 1967, pp 79.

> fessions. Computers launch and guide missiles and antimissile missiles. Computers aid in engineering design, they control machine tools and chemical processes, they keep books, control inventories and make out payrolls...(They) are used in alphabetizing and correcting text, in justifying and hyphenating lines of type, in the retrieval of medical information and in the analysis of voluminous business, social, and historical data... (Appendix J goes into further detail about applications, scientific and technical included.)

Among the ten major findings and recommendations are a few of interest worth repeating:

> 1. Colleges and universities in cooperation with the Federal Government take steps to provide all students needing such facilities with computing service at least comparable in quality to that now available at the more pioneering schools.
>
> 2. Colleges be encouraged to provide adequate computing through government sharing of the cost.
>
> 4. An expanded faculty training program to provide adequate faculty competence in the use of computing in various disciplines.
>
> 5. The Federal Government expand its support of both research and education in computer sciences.
>
> 7. Universities and the Government cooperate in the immediate establishment of large central educational computing facilities capable of serving several institutions.
>
> 9. NSF and the Office of Education jointly establish a group which is competent to investigate the use of computers in secondary schools...

It is obvious that the Report reflected the trends in the technology that existed at the time it was written. For example, if the work of the panel was repeated now there would be more recognition of the role that small computers can play in education. Computer companies today are more anxious to get their products into high schools than they were in the mid-1960s. The government has done much in recent years, through the National Science Foundation, for example, to help colleges and universities get computing power. A train of action is moving along the tracks advocated by the Pierce Committee, but at low speed considering how many years have elapsed since the report was issued. About now, the field of computing is reaching its infancy. To the extent that it picks up more speed, there will be a direct effect on the way scientific and technical information is gathered, stored, retrieved and delivered.

CAIRNS (SATCOM) REPORT [1]

The SATCOM Report is monumental in several ways. It took three years to complete. It resulted in what Rowena Swanson[2] called a magnum opus of 322 pages, containing 55 recommendations. It involved 25 committee members, 7 associate members, 200 consulting correspondents, and four task groups (scientific and technical information problems of the Department of Interior, the handling of toxicological information, the application of copyright to computer usage, and the interchange of scientific and technical information in machine language. More well known scientists and engineers participated in the survey than any other study of science communications before and after.

The study was undertaken at the request of the Office of Science and Technology and the National Science Foundation, the latter supporting the effort with a sizable grant. One reason for commissioning the study was the increasing concern that the technical (scientific) community addressed in the Weinberg Report was not responding to the recommendations made in the PSAC (Weinberg) Report. It was felt that the diffusion of the recommendations in the White House study required further stimulation and that a NAS-NAE independent effort might achieve this goal. Recognition was also given to the fact that most scientists were concerned less with the imperatives of the information explosion and information technology revolution than they were with more traditional communication concerns embodied in the membership in "invisible colleges" and scientific journals availablity for their research publications. They were largely unmoved by the requirements that "Big Science" placed on more advanced, "institutionalized" scientific and technical information programs.There was no applause for the formation of the specialized information centers called for in the Weinberg Report. There was no outpouring of support for state-of-the-art reviews and high quality compaction of data. There was simply no reaction from scientists conditioned to regard science communication as personal interaction with colleagues and scientific publications.

[1] Cairns, Robert W. et al, Scientific and Technical Communication: A Pressing National Problem and Recommendations for its Solution, A Report of the Committee on Scientific and Technical Communication of the National Academy of Sciences and the National Academy of Engineering, Washington, D.C., June 1969, pp 322, plus separate synopsis. pp 30.

[2] Swanson, Rowena W. SATCOM in Review, DATAMATION, February 1970, 5 pages, 98-104.

To expect the SATCOM Report to change the attitudes of scientists in and out of the government would have been unrealistic; at best it could influence only a small number of scientists and engineers by magnifying the need for greater understanding on their part for the dynamics of change and taking actions within their own activities to implement the SATCOM recommendations given the opportunity. The Weinberg Report at the least influenced the information programs of the Federal R&D agencies. The SATCOM Report did not do the same for the non-governmental science community. In essence, the problem continues. This blunt appraisal should not be construed as an attack on the excellent report turned out by the Committee on Scientific and Technical Communication. As a product, the Report contains insightful findings and intelligent recommendations. A summary of the major recommendations is provided to demonstrate this fact.

1. The first and major recommendation called for the establishment of a Joint Commission on Scientific and Technical Communication to be responsible to the Councils of the two academies. It would have a permanent secretariat and would work with the public and private sectors to achieve common goals. It would help advise, coordinate, and seek to maximize cooperation. The SATCOM group could not find a better place than the academies to have such a function carried out.

2. The second recommendation was that there be shared responsibility between the public and private sectors in the management of scientific and technical information. The combined efforts of both sectors would be needed to achieve an effective and economical national STI program.

3. The third recommendation called for a guiding principle which would ensure that all government-sponsored STI programs directed in major part to workers outside of the government or to workers in the government doing work similar those outside should be managed in part or in whole by the appropriate societies or institutions jointly created by such societies or by commercial organizations. Federal agencies would be expected to set up and operate mission-oriented information programs. Privately operated basic information services would operate as components in the government operations. Exceptions to this rule would be the three National Libraries (Congress, Medicine and Agriculture).

4. This recommendation called on the Federal Council for Science and Technology to extend its 1961 policy on page charges "to embrace as integral to the sponsorship of R&D not only the publication but also the processing of the information so generated for access, consolidation, and use in education, training, and application."

5. The fifth recommendation called on sponsors of major programs such as resources management, environmental control urban renewal, etc. (problem-solving information systems) to establish tailored information systems to achieve necess ary goals. Mission-based and discipline-based systems in place should support these broad programs.

6. The sixth recommendation asked that policy-making groups of the scientific and technical societies must encourage major information services managers to develop ways by means of which international access, transfer, and work-sharing would be encouraged.

7. The next three recommendations covered ways to make international flow better.

8. The 10th recommendation endorses the statutory establishment of a national commission to study the impact of new information technologies on copyright principles.

9. The 11th recommendation asked that there be a working group on standards to operate under the Joint Commission on Scientific and Technical Communication.

10. The SATCOM group made 44 additional recommendations. Some of these include:

- o Scientific and technical societies do more to obtain critical reviews and data compilations.
- o Provide for better ways of accessing reviews appropriate to user needs.
- o More support and better efforts in abstracting and indexing
- o Identify major information analysis centers and stimulate wider use of them.
- o Sponsors or operators of major STI programs should undertake continuous evaluation of performance.
- o All disseminators should use the best marketing techniques possible.
- o Federal agencies should fund literature access services needed for the effective use of the knowledge they generate through R&D.
- o Major publishers should use new information technology; smaller ones should merge th eir production activities.
- o Students should be trained in the use of the information technology and the gathering of needed information.

It will not be productive to list other recommendations made in the report; they follow along the same line: more growth in the private sector, more Federal support for information activities in the private sector, increased focus on international information exchange, and the like.

1.9

The reaction to the SATCOM Report in the Federal agency sector was mixed. Some managers expressed the view that the focus was largely on strengthening the private sector programs. It seemed to them that SATCOM Report drafters wanted to see a pendulum swing in that direction. Improving the STI service function really did not get any new support and research and development in the information arts and sciences did not receive as much attention as it needed. Some of the Federal managers found that the Report did no harm to any faction, even though there was a thread of philosophy thoughout the report which favored views expressed by the private sector. Others were critical that the Report was much too long; it had too many recommendations, thus watering down the importance of each. In and out of the government, there was a feeling expressed that the Committee had labored long and hard and concluded as its prime finding that there ought to be a permanent group in NAS-NAE to continue the effort. Some concern was expressed about finding the funds to support an on-going effort. Funding came in for additional discussion, i.e. providing more R&D funds to support efforts beyond that of page charge assistance. There was some consensus that little attention would be given to such an extension.

With the passage of a year or two, the SATCOM Report joined the Baker, Weinberg and other similar studies on the shelves, and the community of thinkers who had contributed to its preparation drifted apart. The two academies did little on their own in the following years to capitalize or exploit their milestone effort. "The Pressing National Problem," which was part of the sub-title of the Report continued to be just that up to today.

KENNEDY (INTERGOVERNMENTAL INFORMATION) REPORT[1]

Not all of the studies being undertaken in the Executive Office of the President centered on scientific and technical information during the last half of the 1960s. There was one worth mentioning that was undertaken by the Intergovernmental Task Force on Inform-

[1] Kennedy, John A. et al, The Dynamics of Information Flow, a Report by the Inter-Governmental Task Force on Information Systems, Washington, D.C. April 1968, pp 31.

ation Systems, under the sponsorship of the U.S. Bureau of the Budget and the Advisory Commission on Intergovernmental Relations. Representatives of the Federal state, county and city governments participated. During the course of the study, some interaction took place between the leaders of this effort and the Office of Science and Technology, since the Intergovernmental Committee recognized that there would be an increasing flow of scientific and technical information among this community with the passage of time and the perfection of the communication channels. The concern of the Committee was in getting better information to plan, operate and evaluate programs that meet public needs. As the needs grow in complexity, many programs take the form of cooperative arrangements involving joint action and the sharing of resources by several governmental levels. The panel study found that it was difficult to exchange information quickly and economically among governments; that information is often unreliable, and difficult to summarize and evaluate; that there is a duplication often unnecessary of systems dealing with similar kinds of information; that the lower elements of government are frustrated in developing coordinated, unified systems, and that scarce resources are being wasted unnecessarily. The Report offers reasons for this disarray and lack of proper flow of information.

Twenty recommendations were offered to reach 7 goals. Consensus was reached as to which group would take over responsibility for the specific recommendations listed under each of these goals. They included efforts to coordinate, joint fund, facilitate decision-making, improve information exchange, create clearinghouses, achieve compatability, and issue guidelines for action. The report is well written and a model for achieving interchange at different, autonomous levels of government.

Coordinating and interacting with this task force was instructional. While much of the information to be exchanged dealt with health, crime, transportation, and many other kinds of programs, the dynamics of information flow of systems building had much simiairty to the problems, trends, issues, needs, techniques and mechanisms that are found in the field of scientific and technical communication.

1.9

NATIONAL ENGINEERING INFORMATION CONFERENCE REPORT[1]

This Conference was undertaken by the Office of Science and Technology in cooperation with The Tripartite Committee to foster the development of information systems designed to serve engineers. In particular, it was intended to direct the attention of managers and administrators on existing engineering information resources and developing information systems in the belief that solutions to many of the nation's pressing problems will require major contributions by the engineering community. The scope of the conference is indicated in the major groupings of papers on engineering information communication problems, illustrative programs in government and the private sector, and international engineering information programs. A panel discussion on engineering communications is also reported.

The conference welcoming was made by Lee A. DuBridge, the Science Advisor to the President and the Director of the Office of Science and Technology. Some of the views of this grand old man of science are worth repeating:

> "When I was a student, the only information device went under the code word "BOOK" and it seemed that the book was an adequate means for exchanging information. Irecall that by reading material from our different physics journals each month, and occasionally a book or two which came out, I felt that I was well in touch with all the fields of physics that concerned me and the work that I was trying to do. As time went on, and the"Physical Review" got fatter and more frequent, and as more and more journals appeared, it gradually dawned on me, as it probably has on all of you, that the problem of exchanging information in a very large scientific and engineering population, to say nothing of the population in other areas, had become a major problem - indeed, this problem of information exchange had a science and technology all its own. I think we do not yet know how to advance this science and technology adequately, nor especially do we know how to use it effectively and adequately. I hope conferences such as this will give us some light on the question of whether it is possible to get information from the brain of one individual to the brains of other individuals who need that information in an effective, comprehensible, understandable, and condensed way. There is a further requirement that this information be strained, filtered, abstracted, and possibly interpreted, so that it becomes as comprehensible to the recipient as it presumably was to the original donor, and this requirement is a problem to which I really don't know whether there is an answer..."

[1] Proceedings of the National Engineering Information Conference, Sponsored by the Office of Science and Technology, Executive Office of the President, in Cooperation with the Tripartite Committee, Distributed by the Engineers Joint Council, New York, N.Y., June 1969, pp 121.

1.9

Dr. Walker followed up with a summary of the recently released NAS-NAE SATCOM Report. Among his comments about the Report was a finding that there was "a diverse and pluralistic network of communicaion activities that, though often criticized and not at its maximum level of efficiency, nevertheless functioned reasonably well." Two speakers picked up on this statement and came to different conclusions. In his penetrating paper on the Needs of Practicing Engineers, Walter M. Carlson of the IBM Corporation, and formerly Director of the Defense Technical Information Program, stated:

> "Three years ago the Academies formed a Committee on Scientific and Technical Communication. The report of that committee is now available, but it still leaves to the uncertain future the national problems faced in the handling of information in support of the practice of engineering. The committee does make one key point, however, which I will reinforce in several ways, when it describes today's situation as "a diverse and pluralistic network of communication activities that, though often criticized, functions reasonably well," and later says, "there is no evidence of critically inefficient operation" in the nation's scientific and technical communications.. This considered opinion - that there is no urgent or nationally directed need for new engineering information or data systems - may come as a severe disappointment to that large fraction of this audience who came to this conference hoping for some official blessing of their pet information projects...As J.C.R. Licklider will tell you later, the patterns of information and data flow are set for the engineer during his formal education, and they do not change very much thereafter..."

After the Carlson presentation, Professor J.C.R. Licklider addressed the subject, Orientation of Young Engineers Toward Use of Engineering Data and Information Systems, an equally brilliant presentation. At that time, Dr. Licklider who headed Project MAC at MIT, remarked:

> "...I became convinced that the new generation coming up in engineering is qualitatively different from the old one. I have the feeling that we can hold up the arrival of the future by assuming that things are, as Walter Carlson quoted the SATCOM report, "not critically inefficient and working farily well." We can hold it up, but not for very long, because the young people are coming along. From what I have observed, I have drawn the conclusion that the young people are not going to be satisfied with this system that we think is working pretty well. They are going to say, not "the more things change the more they stay the same," but "If things don't change, if you don't change them, then of course they stay the same, and perhaps we will change them when we get a chance."

Both Licklider and Carlson are discerning observers. Both have made significant contributions to better scientific and technical communications. It is doubtful that this small area of disagreement was more than momentary. The purpose of this tale was to

underline the spirit of the Conference, an elan hard to capture in a report of proceedings. The other speakers whose comments are included in the Report which was prepared by Frank Y. Speight, its editor, also made the Conference the unique success that it was. In particular, the speakers from England,Canada and the Organization for Economic Cooperation and Development (OECD) - Cyril G. Giles, Jack E. Brown and Peter Judge, respectively - added an international flavor. Only one other speaker will be quoted, Representive Emilio Q. Daddario, Chairman of the Committee on Science and Astronautics, who did so much to crusade for better scientific and technical information programs in the Federal government and in the nation. Plucked from his speech are the following observations:

> "...information is more than just a parochial resource to be used in a haphazard way in an agency or by a Congressional committee, and I would agree with the 1965 report of the Senate Committee on Government Operations, which characterized information as a federal, national, and international resource...The need for an effective scientific and technical information system is undeniable, but the lack of resolute action to create such a mechanism is unfortunate as, indeed,it is unnecessary. There are many in Congress who share my discomfort as we view the strenuous efforts undertaken by blue ribbon groups during the past decade - efforts which resulted in excellent thought-provoking reports but no subsequent implementing action..."

Mr. Daddario traced some of the actions of other members of Congress over the years who sought a stronger Federal program to manage scientific and technical information programs in order to promote increased efficiency of Federal R&D programs and raise the level of achievement in national science and technology. His sobering and well-directed words to the attendees at the Conference helped make the National Engineering Information Conference a pleasing and acknowledged success.

ROSTOW REPORT[1]

On August 14, 1967, President Lyndon B. Johnson transmitted a document to the 90th Congress, dealing with global communications.[2] In a sense, it is a companion piece to the Geneen Report on the White House Conference on International Cooperation which was written about earlier in this book. Both the Rostow and Geneen Reports are indicators of the excited feeling that President Johnson had for international communication and its importance for the people of the world. The opening statement in his communication to Congress reveals this enchantment:

> "Man's greatest hope for world peace lies in understanding his fellow man. Nations, like individuals, fear that which is strange and unfamiliar. The more we see and hear of those things which are common to all people, the less likely we are to fight over those issues which set us apart. So the challenge is to communicate. No technological advance offers a greater opportunity for meeting this challenge than the alliance of space exploration and communication. Since the advent of the communications satellite, the linking of one nation to another is no longer dependent on telephone lines, microwaves or cables under the sea. Just as man orbited the earth to explore the universe beyond, we can orbit satellites to send our voices or televise our activities to all peoples of this globe. Satellite communications has already meant much in terms of human understanding.
>
> - When President Lincoln was assassinated, it took 12 days for this news to reach London. Britons watched and grieved with us at the funeral of John F. Kennedy.
> - Europeans watched Pope Paul speak to the United Nations in New York - and Americans saw his pilgrimage to Fatima...
>
> The future of this new technology stirs our imagination.
>
> In business and commerce -
> - Commercial telephone calls will be carried routinely by satellite to every part of the globe.
> - Rapid and universal exchange of data through satellite-linked computers will encourage international commerce.
> - Productive machinery can be operated at great distances and business records can be transmitted instantaneously.
>
> In education and health -
> - Schools in all lands can be connected by television - so that the children of each nation can see and hear their contemporaries throughout the world.
> - The world community of scholars can be brought face to face discussions via satellite.
> - Global consultants, with voice and pictures, can bring great specialists to the bedsides of patients in every continent.
> - The art, culture, history, literature and medical science of

[1] Rostow, Eugene V.et al, Final Report of the President's Task Force on Communications Policy, A report prepared by an Executive Branch Committee representing 14 Federal Agencies, which was convened as required by the Presidential Message on Communications Policy of August 14, 1967. The Report is dated December 7, 1968, pp 30.

[2] Message to Congress from the President of the United States, Recommendations Relative to World Communications, 90th Congress, 1st Session, Doc. No.157, August 14, 1967, pp9.

> all nations can be transmitted by satellite to every nation... One of the challenges before us is to integrate satellites into a balanced communications system which will meet the needs of a dynamic and expanding world society. The United States must review its past activities in this field and formulate a national communications policy....We support a global system of commercial satellite communications which is available to all nations - large and small, developed and developing - on a non-discriminatory basis.... I am appointing a Task Force of distinguished government officials to make a comprehensive study of communications policy... This message does not create a new communications policy for our nation. Rather it proposes the foundation for that policy. It affirms our intentions as a partner in INTELSAT. It considers the need for modifications in our international communications posture. It sets in motion the necessary studies for a better understanding of policy needs in domestic and international communications.....Historians may write that the human race survived or faltered because of how well it mastered the technology of this age.

How fascinating it is that the President known as the "Great Wheeler-Dealer" was able to grasp the significance of the merger of satellites and computers in the affairs of all men and how this one-time school teacher turned politician recognized that the new information machinery could provide a breakthrough in how knowledge is transferred.

When the Rostow Report came to light in 1968, it received considerable attention. Virtually every editorialist in newspapers and magazines reacted to its contents and recommendations. Because its focus was almost exclusively on telecommunications - only tenuously on information - the gist of its recommendations will be covered to impart the flavor of the product to the reader. The Introduction covers much of the same ground the President covered in his message to Congress. The Task Force pointed out that the potentialities of telecommunications are both inspiring and frightening, since the modern methods of communications can be instruments of enlightenment or the tools of tyranny, a valuable reminder not present in the more positive approach taken by the President. Here are several other thoughtful observations and recommendations made by the Rostow group.

- New services promise to revolutionize customary patterns of business, finance, learning, entertainment and leisure, and the processing, storage and retrieval of information. Above all, they offer the citizen everywhere the opportunity to acquire the knowledge and the insight essential to the mature exercise of his responsibilities.

- We have not interpreted our mandate to require a study on our part of the content of communication, or of the challenges we face in establish-

> ing rules of the game for the exercise of the power and the privilege of mass communication. But an awareness of these problems is the context of our study.
>
> The social and psychological effects of mass communication define one of the most important of all fields of research, both for public and for private groups, in the years before us.
>
> Four axioms guided our work: The United States remain a leader in world communications science and technology, and in communications service. Telecommunications policy should seek to maintain and develop an environment always sensitive to consumer needs, i.e., to transform the fruits of technological knowledge into tangible benefits for the public, through cost-reducing innovation and well-conceived public policy. The realm of telecommunications should be viewed as a system, extending from public and private research, at one end of the spectrum, to the provision of private and common carrier communications at home and abroad at the other end. Special consideration should be given to the needs of developing countries.
>
> The most pervasive of our findings is the need to strengthen governmental capaiblities in FCC and the Executive Branch to develop and implement policies which will enable the private sector to reach its full potential.
>
> We should establish policies and institutions adaptable to change, to respond constructively to new opportunities, to removing impediments, and by improving incentives. The relaxation of some restrictions may be desirable in broadcasting.

The Report obviously contains much more than the above, including a number of technical recommendations, not repeated here. The accent of the study was on communications,domestic and global.Most members of the task force were not experts on telecommunication, they were all government officials. Eugene V. Rostow, the chairman, was Undersecretary of State for Political Affairs, State Department; Donald F. Hornig, was the Director of the Office of Science and Technology; Leonard H. Marks was Director, United States Information Agency; Willis H. Shapley represented James E. Webb, Administrator, NASA, Charles Schultze and Charles Zwick, came from the Bureau of the Budget. These are several of the cast representing 15 agencies and departments of the Federal Government. The report received some criticism at the time of its release, but this seemed to have been the fate of almost any effort to seek better planning and operations in the communication area. Information scientists and managers should be familiar with what it was and what it called for, but the major reason for its inclusion is to credit President Lyndon B. Johnson for his love affair with communications as a tool for peace and progress.

THE MANAGEMENT OF INFORMATION AND KNOWLEDGE [1]

It has been a mystery over the years why the Committee on Science and Astronautics Report on The Management of Information and Knowledge did not get the attention it deserved. The prime mover of that splendid annual meeting that produced the report was Rep. Emilio Q. Daddario and his excellent staff. The moderator was Daniel Bell of Harvard University. Keynote remarks were provided by McGeorge Bundy, president of the Ford Foundation, Ear Warren, retired Chief Justice, and Daniel Bell, the world famous sociologist, who is identified by his insights about the post-industrial society, a label that he originated. Papers were delivered by Herman Kahn (futurist), Stafford Beer (cybernetician), Daniel J. Boorstin (historian), Paul Armer (computer scientist), Osmo A. Wiio (professor of organization theory), George Kozmetsky (educator) and Thomas F. Green (educator).

The Introduction to the Report was written by George P. Miller, Chairman of the House Committee on Science and Astronautics. Here are some excerpts:

> "The annual meetings of the Committee on Science and Astronautics with the Panel on Science and Technology are intended to stimulage the mind - to encourage discourse and exchange of ideas on subjects of current interest or contention. To that end, this year's 11th Panel, aimed at the broad theme of "the Management of Information and Knowledge," was triumphant. The 3-day fare of papers and discussion can be epitomized by Alexander Pope's phrase, "The Sweeter banquet of the mind." Rapid development of the computer and the revolution in communications technology are having an impact upon our society. This impact was examined critically in papers presented by 10 eminent educators, sociologists, and scientists from the United States and four foreign countries....Their thoughts are intellectual nutrition to be relished by Congress, the American public, and scientific and academic communities worldwide...I commend these papers to all persons concerned with the relentless march of information and knowledge."

[1] Committee on Science and Astronautics, U.S House of Representatives, U.S. Congress, The Management of Information and Knowledge, a compilation of papers prepared for the 11th meeting of the Panel on Science and Technology, February 1970, pp 130.

> our deliberations in the next two or three days more pregnant for the coming years in being able to guide our lives and lives of our children.

Interdependency in a postindustrial society, application of wisdom to the problem of information and knowledge, a society uniquely dependent upon the compilation of theoretical knowledge, and the problem of organization of human capital in a postindustrial society - these were the major and minor themes that Bell identified for inquiry by the speakers and attendees at the conference.

Herman Kahn picked up the theme of the postindustrial society and an "emergent United States." Referring to the first, Kahn stated that we simply do not know what a post-industrial culture is. He explained the emergent U.S. culture as he saw its future shape with 18 predictions. A few of these include:

> Market may play a diminished role compared to public sector and "social accounts. Widespread use of automation, computers, and cybernation. Narrow economic efficiency no longer primary. "Small world" (but "global metropolis" not "global willage." Typical "doctrinal life time" 2 to 20 years. Learning society - emphasis on late knowledge, imagination, courage, and innovation - deemphasis on experience, judgement, caution. Business firms may no longer be the major source of innovation or center of attention...

With his customary bravery, Kahn forecasted the components of a relatively a-military, relatively a-political, "surprise free projections of the most significant aspects of the final third of the 20th century. Only a few of these are provided the reader:

> Much turmoil in Afro-Asia and perhaps Latin America; worldwide (foreign and domestic)law and order issues; populist and/or conservative backlash and revolts; onset and impact of new political milieu; a general decrease in consensus and authority - a general increased diversity (and some increased polarization) in ideaology, in value systems and in life styles...

Kahn asked - Do you know what the business of America is today? He answered, the old view that the business of America is business has vanished. It is now the task of creating a new society!

Sir Stafford Beer made a number of trenchant observations. Examples include:

> The elements of our society ever more richly interact: the more this happens, the more participation is invoked, the more the stream of data flow...the more complex does society become. Handling complexity seems to be the major problem of the age, the way that handling material sub-

technologists, and scholars on the management of information and knowledge... I was really shcocked by my limitations in this field of knowledge a week ago when I read in the morning newspaper that a computerized and live nationally televisioned prize fight had been held the night before between two former heavyweight ch ampions, one of whom had been dead for many months and the other who was still alive. I was further amazed to learn that in theaters throughout the country boxing fans had paid $4.50 for seats to witness it. But I was truly shocked when I read that the live man was knocked out after 57 seconds of the 13th round...I do not know what implications such use of the machine (computer) would have upon the individual or the state, and I am sure it would be better for me not to speculate because that is not the role of a judge. Traditionally, judges are not in the vanguard of any movement, nor are they supposed to survey the future to determine what should be done in the face of possible advances in science, technology or human reactions to either. They are tied to the words of the Constitution and the statutes as they were meant at the time of enactment, in addition to that, and largely to interpretations of the past..But this does not mean that courts should be or are impervious to change. They, like all our institutions, must be oriented to the times and the conditions under review. In this regard, I am reminded of the agaonizing the courts have experienced in defining and applying the world "commerce" as it is used in the Constitution. That document states in simple language: "Congress shall have the power to regulate commerce with foreign nations and among the several States and with the Indian tribes." In the economy of those days, commerce was not a complicated activity, but was confined to traffic involving sailing vessels and animal-drawn vehicles. With the coming of the railroad, telegraph, telep-one, aircraft, radio, television, and electronics, the courts have agonized for 182 years to find an accommodation between such advances and the word "commerce." ...It is to discuss such problems (invasion of privacy and improper use of technology) as well as the beneficence of scientific and technological advances that I assume this meeting is being held. It is a matter of the greatest importance."

Daniel Bell: This is a unique educational enterprise, even more so by the fact that it is intitiated by Congress. It brings together Members of the Congress, members of the scientific and academic community, and an interested public to discuss not a specific legislative issue, but a broad theme and to try therefrom to pool knowledge, provide some public understanding and perhaps some guidelines in identifying relevant problems. Perhaps we can pool our experiences, good and bad, in an effort to apply wisdom to the problem of information and knowledge. I have been asked to set some context in which this this discussion will take place. The context I want to set is the next 30 years - not arbitrarily, but symbolically - and the proposition I wish to put forward is that the development in which all are efforts are taking place is the emergence of what I have called a postindustrial society. (Such a society) is organized around information and utilization of information in complex systems, and the use of that information as a way of guiding the society... It is also a society uniquely dependent upon the compilation of theoretical knowledge...In effect,...those institutions primarily concerned with the codification of theoretical knowledge become primary to society, a reduction of empiricism and a growth of theory; theory, not only in the relation of science to technology, but also in the relation of economics to public policy... The organization of human capital is a very real problem ina postindustrial soc iety. To this extent, it seems to me that the kinds of problems we face are new and difficult...There are elements of interdependency and complexity in a postindustrial society which are genuninely novel in history. This makes

Those who knew George Brown would recognize that he was not in the habit of making such extravagent statements, but in this instance he was fully justified to label the intellectual product of the Panel meeting so aptly. A few excerpts are provided to give the reader a sampling of the content and ambiance of the compilation of papers.

McGeorge Bundy: "The problem is that in most, if not all spheres of inquiry and choice, quantities of raw information overwhelm in magnitude the few comprehensive and trusted bodies or systems of knowledge that have been perceived and elaborated by man. I'm thinking, here, not only of knowledge systems with predictive value, but also of information systematically organized to yield the benefit of comprehensive description. Where, for example, does the novice urban mayor turn to comprehend the dynamic interrelationships between transportation, employment, pollution, private investment, and the public budget; between housing, nutrition, health and individual motivation and drive? Where does the concerned citizen or Congressman interested in educational change go for the best available understanding of the relationship between communications, including new technology, and learning? ...The faith of the modern rationalist is that the family of man can reap important social benefits if it harnesses the capabilities of modern systems of information analysis and storage to convert dara into knowledge, and then applies the product as widely as possible to issues of social and personal choice. If I have correctly stated the elements of the faith framing this assembly and its deliberations, then I register as more, rather than less, of a believer...In the era of information explosion, societies can become paralyzed over a plethora of facts and the absence of obvious conclusions. Or they may freeze when the indisputable facts and necessities offend received values and conventional wisdom. Neither form of paralysis is likely when the linkages between the arena where policy is forged and the relevant circle of informed and disinterested citizens and scholars are firm and easy..."

Earl Warren: "...until the passing of time compelled me to start thinking about what I would ...I never realized how audacious it was for me to assume that I had sufficient knowledge of these changes to justify my attempting to keynote a discussion by scientists,

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sisting of translation and analysis followed. They undertook visits and close interaction between the professors and officials at NASA's Manned Spacecraft Center, Kennedy Space Center, Goddard Space Flight Center, and NASA Headquarters. Considerable information was provided by the Redstone Scientific Information Center,a facility of the Marshall Space Flight Center. To get the political outlook, they met with several representatives of Congress, including Senator Jennings Randolph (West Virginia), Representative John W. Davis (Georgia) and Representative Roman C. Pucinski (Illinois). They closely analysed COSATI studies and the then available SATCOM Report, which was produced by the National Academy of Sciences-National Academy of Engineering in 1969.

They suggested at the end of this diligent effort that there was a need - an alarming need - to improve the use of our great and growing natural resource termed "information" and the way to do it was to establish UNISTAR - the User Network for Information Storage, Transfer, Acquisition, and Retrieval. UNISTAR would provide a wide range of services to satisfy user priority needs; be evolutionary, possessing the ability to grow, adapt, and provide for feedback; be technically effective and economically feasible; be integrable with existing systems; and to provide information, personnel and relationships to facilitate effective decision-making throughout the system. Selected were four elements to comprise the information management system elements: information users, information and data processing, data and information sources, and management analysis. The behavior and development of each of these elements would be guided by an all-pervasive policy. Although UNISTAR would be a national system for handling all STI, a prototype UNISTAR system was proposed for handling earth resources information. A chapter to explore each of the four elements (users, processing, sources and management). The preparation of each of these chapters also the prototype UNISTAR system for earth resources information resulted in products of high quality. Dr. Vachon and his associates turned out a splendid piece of research, an unexpected and valuable addition to the series of studies seeking improved national and Federal scientific and technical information systems. NASA is congratulated for supporting the project. The report deserves much wider dissemination and reading than it has received.

PIGANIOL REPORT [1]

There is hardly any doubt but that the report on Information for a Changing Society has been read more extensively around the world than any other on scientific and technical information. It was hailed when it came out in 1971, a product of the prestigious Organization for Economic Cooperation and Development (OECD), as wise counsel to all governments to give the subject of scientific and technical knowledge high priority. The *ad hoc* group that produced it were of such high status that the success of their studies was insured even before it became public. The chairman was M. Pierre Piganiol, one of the most respected men of science in France. The United States furnished Dr. Lewis M. Branscomb, whose knowledge and accomplishments in science, information and government are nonpareil. Dr. S. Balke, Professor S. Hamada and Dr. J.R. Hookway represented the best thinkers on the subject from West Germany, Japan, and the United Kingdom, respectively. Hookway was the distinguished Chairman of OECD's Committee on Information Policy, who ultimately became the Director of the British Library. The Science Adviser to the Canadian Government, Dr. J.R. Whitehead, who himself was the author of the OECD "Whitehead Report" some years later, was a member, as was Dr. R.V. Tell of Sweden who also acted as the Rapporteur. All who participated in the effort would praise the work of Branscomb and Edward L. Brady of the National Bureau of Standards who did much to write the report. The Chairman said about his team: "I should like to make it clear that I did not really have to act as "Chairman"; the small size of the Group and the high quality of its members meant there was no need for a Chairman in the traditional sense: we worked as a team drawn together by what I believe to be a remarkable convergence of views. It seems as if, after our first, tentative exploration of the problem, we were all forced into agreement by the hard facts of the situation confronting us and it is this, I think, which gives the conclusions we have reached a particular significance and encourages me to suggest that our recommendations merit very careful attention.

[1] Piganiol, Pierre, et al, Information for a Changing Society, Some Policy Considerations, Report of the Ad Hoc Group on Scientific and Technical Information, the Organization for Economic Cooperation and Development, September 1970, pp 48

This new Group was convened to implement the recommendations of the Third Ministerial Meeting on Science. Its charter was to:

> Explore the nature, magnitude and implications of the needs for scientific and technical information and data in science, the economy and society, and how these needs may be met through changes in structures, technologies and policies and management concepts in relation to information; (and) present their conclusions and recommendations for the developing role of scientific and technical information and data systems and the policy and programme resources required for them to fill this role effectively in Member countries.

The Ad Hoc Group was brought into being to set the international and national activities in information into their broad context, and identifying the requirements for their effective and successful development.

The coverning letter carrying the report to the Secretary-General of OECD, written by Pierre Piganiol, contains a few comments deserving attention. Here are some of them:

> Among the hard fact, the central one is economic growth. Technical progress is not just a residual factor compared with the basic elements of capital and labor. In one industry I know well, while salaries have increased by 500 percent, the prices of the products have gone up by 50 percent: this remarkable increase in productivity has been achieved to some extent by an increase in the scale of production (itself a product of a tremendous effort of technical research) but also by real mutations in the technology, which have only become possible through many and varied advances in scientific knowledge.
>
> The problem of scientific and technical information seems to be closely linked with economic growth from two different points of view. On one hand, diffusion of information throughout the scientific and technical community facilitates effective progress in research and development; on the other, information transfer offers industrial management the chance of taking optimal production decisions on a sound basis. But we know that economic growth brings real problems. It has to be mastered. Development should be coherent, and in consequence those responsible for macro-economic decisions require clear information not only on what is happening now, but on what is likely to happen later. Decisions can no longer be based only on present knowledge, but require also a clear vision of the technological future. Finally, such decisions require public support, or at least a discussion of the issues involved between the government and well-informed representatives of the public. Viewed this way, the information problem acquires new dimensions.
>
> ...although scientific information aimed primarily at research workers seems to develop quite independently of economic problems, this is just not true; one can easily show that economic pre-occupations are present even in those parts of the information process that are most scientifically orientated... It is not surprising that our report takes the viewpoint of the information specialists, but...the Group has consistently tried to identify the way in which the "information system" articulates with the structures of economic growth and, more broadly still, with the nature of political decisions.

In this extraordinary essay by Piganiol on the relationship of scientific and technical information to productivity, to technology utilization and to governance, he makes a few other remarks which in reality expand the importance of scientific and technical information in a way that perhaps could not be stated by information scientists and information managers, who might be charged with "gilding the information lily." Piganiol writes in his letter to the Secretary General:

> The effectiveness of human activities can only be assessed on the basis of a complete chain of events, which passes from scientific knowledge and its creation, through the stages of technical research and through many complex deciions, to the production of goods or services, integrated into an economic and political system. Exchange of knowledge is needed within each group of men concerned at each stage of this chain; it may need translating into another "language" for transfer to groups engaged in other tasks. The contribution of the Japanese member of our Group left us in no doubt that a major part of the Japanese success is due to the efficiency of of their knowledge transfer mechanisms. ...It is no longer possible to separate information and knowledge in the social sciences from those concerning the natural sciences. Lastly, such information should not build up a dead structure: the body of knowledge is in continuous evolut ion and it is vital, in order to forecast and influence the future, that information should contain at least the seeds of tomorrow's progress and discoveries. What distinguishes modern information from traditional documentation is precisely the introduction of this heuristic element.

The urbanity of Piganiol's remarks is reflected in many of the insightful observations of the authors of the report. They found that neither the information networks then in existence nor the body of basic technical and social knowledge were adequate to the needs of the times. To them information policy is more than technology - a recognition which is still dimly perceived in the Federal government. In this connection, they wrote:

> Impressed with the enormous volume and complexity of contemporary scientific and technical exchange, many see information policy as a complicated problem in documentation management, but fail to see it as a major component of policy for science and technology. But just as science policy must be an integral part of overall government policy, linked to social and economic affairs, information policy must seek to assure that the world's specialized and professional knowledge is fully and properly used in guiding social evolution. While this perception of information systems as an element of government policy has not yet been widely recognized, there is increasing international interest in the improvement of the information situation...The need to view information policy in this broad context does not imply that any nation today possesses the capability to organize a satisfactory information network.

Digging deeper into the current state of information policies and practices among the OECD countries, the Piganiol group made a number of observations worth repeating:

> Few countries, if any, have a coherent, comprehensive policy covering all related types of scientific, technological, economic, and sociological information...Relationships between various types of information and their importance for economic and sociological development are far from understood.
>
> All OECD countries operated extensive economic and sociological informatioon gathering systems and all make use of existing fragmented mechanisms for making STI available all over the world. However, coordination between disciplines and coordination among nations, while still not very effective is beginning to receive high attention.

The panel indicated that the existence of the Piganiol group was one indication of this trend. Unfortunately, OECD reduced its focus on STI in later years to the detriment of all countries even those outside of the OECD group. Returning to the review of current information policies and practices, the next points made by the Piganiol group follow:

> Recognizing the fragmented state of information systems, the Ministers of Science of the OECD countries recommended that each Member country establish a high level focus for information problems and that...OECD should endeavor to promote cooperation in establishing networks of comprehensive and compatible information systems....To accomplish this objective, the OECD Information Policy Group was established.

Again, the author has to bring the reader up to date. At least in the United States, the temple of the information revolution, the high level focus, who resided in the Office of Science and Technology up to 1971, was eliminated. The task was passed over to the National Science Foundation, which had asked the Science Advisor for it, but it turned out to be a bad decision insofar as maintenance of the function was concerned. Also, unfortunately, OECD changed its organizations dealing with information and computer utilization. The Information Policy Group was eliminated and its replacement did not give high priority to STI matters that the Piganiol Report called for.

Having revealed what happened after the Piganiol Report was issued within OECD, the reader will be given an encapsulated account of what the Panel was asked to do and what it concluded and recommended. The stat ed purpose of the study was to explore STI needs in science, economy and society; to determine needed changes in structure, technologies, policies, and mangement concepts; and to recommend actions for member countries to develop needed STI systems and to attain requisite policies and resources.

Briefly the conclusions are recommendations are as follows:

1. The problem of STI is linked to economic growth. This has been the experience in Japan.

2. It is impossible to separate information and knowledge in the social sciences from those in the natural sciences.

3. Although contributing to progress, the role of the Information Policy Group of OECD has been too narrow and better teamwork is needed with OECD's Computer Utilizatiôn Group.

4. Economy and efficiency require interconnection of fragmented information systems to attain national networks responsive to users; also better user feedback is required, more support for information R&D, and education and training programs.

5. Special help is needed for the developing countries. Regional programs featuring pooling may be helpful to smaller ones.

6. Better information systems are needed for specific groups: industry, decision-makers, planners, managers, government and laymen. All need better understanding of the dynamics of change.

7. Government focal points should be appointed at the highest levels to develop necessary goals, policies, and to integrate the programs.

8. Policies and strategies for STI are an integral part of R&D and should not be developed separately.

9. Pilot programs in a few priority areas are recommended; examples: water resource management and urban development.

The greatest value of the report was that it pointed out that Government and other leaders should regard STI as a key resources not only for science and technology but for other purposes of society. This recognition supported an upgrading of the subject in all countries of the world. It should be revealed that the study was undertaken against the counsel of the Information Policy Group which feared that it might cause organizational change. When it came out the secretarial of the Information Policy Group

was hostile to the finding that its role was too restricted. The members of the In= formation Policy Group took a more magnanimous outlook, however. But all in all, the Piganiol Report was a forward step and plays a key role in advancing the understanding and planning of Federal, national and international scientific and technical information programs.

THE INFORMATION SOCIETY: A YEAR 2000 JAPANESE NATIONAL GOAL [1]

But even more spectacular was the so-called Japanese White Paper, a masterpiece of of analysis, speculation and projection that was issued with considerable fanfare during the same period as the Piganiol (OECD) Report. In this document, Masada and his fellow contributors in the Japan Computer Usage Development Institute (JCUDI) came up with a global approach to the information technology revolution and information explosion solution. Up to this point, most observers of the oncoming Information Age confined their attention to technology and its impact on information-handling. More often than not, only a phase would be addressed. The Japanese spokesmen painted their conclusions and plans for the future on a much larger canvas. They said:

> "It is our conclusion that Japan has to change its goal from industrialization to informationalization to prevent social and economic problems such as dollar shock, pollution, and congestion in urban areas, which have been caused by the extention of industrialization. We propose that the final national goal be a new information society which will bring about a general flourishing state of human intellectual creativity by the year 2000 with 1985 the median goal year of the plan."

The projected information society would be a postindustrial society in which processing and handling of information consititute the leading edge of the economy. The project for the Japanese, the spokesmen beleived, would be the Japanese equivalent of the Apollo Project in the United States. The import ance of "informationalization" is so great, according to the White Paper that it needs to be discussed in the National Diet and by other government and private organizations. The White Paper reveals that

[1] Masuda, Yoneji et al, Computer White Paper on The Information Society: A Year 2000 Japanese National Goal, Japan Computer Usage Development Institute, Tokyo, Japan, 1970-1971, pp 157